

I claim:

1. A method for electrically forcing cardiac output during an arrhythmia in a patient, comprising the steps of:

(a) attaching electrodes to the patient's chest;

5 (b) confirming the presence of an arrhythmia; and

(c) delivering electrical current pulses through the patient's chest by means of said electrodes said electrical current pulses being delivered at a rate between 60 and 200 beats per minute and said electrical current pulses having a sufficient strength to directly force contraction in the patient's heart, whereby the method provides a level of cardiac

10 output sufficient to maintain life.

2. The method of claim 1, further comprising the steps of reassessing the presence of an arrhythmia at predetermined intervals and terminating said delivery of electrical forcing pulses if the arrhythmia is no longer present.

15

3. The method of claim 1, in which the arrhythmia is asystole.

4. The method of claim 1, in which the arrhythmia is a tachycardia.

20

5. The method of claim 1, in which the arrhythmia is fibrillation.

25 6. The method of claim 1, in which each electrical current pulse has a maximum energy of less than 360 joules.

7. The method of claim 1, further comprising the steps of monitoring cardiac output and adjusting electrical current pulse amplitude to maintain a predetermined level of cardiac output, thereby conserving electrical energy.

8. The method of claim 7, in which cardiac output is monitored by external blood pressure monitoring means.

5 9. The method of claim 1, in which each electrical current pulse is shaped with rounded edges thereby minimizing patient discomfort and chest twitching.

10 10. The method of claim 1 in which each electrical current pulse is formed of a train of at least 10 narrow pulses thereby minimizing patient discomfort and chest 10 twitching.

11. A device, for implantation in the human body, for maintaining cardiac output using forcing fields, comprising:

15 (a) battery power supply means;
b) arrhythmia detection means connected to said battery power supply means;
and
20 (c) output control means connected to said arrhythmia detection means and connected to said battery power supply means for delivering multiple electrical current pulses to the human heart after the detection of an arrhythmia, wherein the maximum voltage of said electrical current pulses is less than 375 volts, contraction in the patient's heart is directly forced and a level of cardiac output sufficient to maintain life is provided.

25 12. The device of claim 11, in which said electrical current pulses are delivered at a rate between 60 and 200 beats per minute.

13. The device of claim 11, in which said battery power supply means has sufficient capacity to deliver said electrical current pulses for at least 1 hour.

14. The device of claim 11, in which the arrhythmia is a tachycardia.

5

15. The device of claim 11, in which the arrhythmia is fibrillation.

16. The device of claim 11, further comprising blood pressure monitoring means.

10

17. The device of claim 11, further comprising oxygen content of the blood monitoring means.

15

18. The device of claim 16, in which said blood pressure monitoring means monitors cardiac output and said electrical current pulse amplitude is adjusted by said output control means to maintain a predetermined level of cardiac output thereby conserving electrical energy.

20

19. The device of claim 11, in which each electrical current pulse is shaped with rounded edges, thereby minimizing patient discomfort and chest twitching.

25

20. The device of claim 11, in which each electrical current pulse is formed of a train of at least 10 narrow pulses, thereby minimizing patient discomfort and chest twitching.

21. The device of claim 11 in which said arrhythmia detection means reassesses the presence of arrhythmia at predetermined intervals and said electrical current pulses are stopped by said output control means if the arrhythmia is no longer present.

5 22. The device of claim 11, further comprising means to perform conventional anti-tachycardia pacing thereby providing the electrically forced emergency cardiac output in the event of anti-tachycardia pacing causing a ventricular fibrillation.

10 23. The device of claim 11, further comprising means to perform tachycardia cardioversion, thereby providing the electrically forced emergency cardiac output in the event of cardioversion causing a ventricular fibrillation.

15 24. The device of claim 11, further comprising means to perform atrial defibrillation, thereby providing the electrically forced emergency cardiac output in the event of atrial defibrillation causing a ventricular fibrillation.

25. A method for electrically forcing cardiac output during an arrhythmia, comprising the steps of:

20 (a) detecting the presence of the arrhythmia in a human heart; and
(b) delivering electrical current pulses through said human heart; wherein said electrical current pulses are delivered at a rate of between 60 and 200 beats per minute, and wherein said predetermined electrical current pulses are strong enough to directly force contraction in parts of the patient's heart; thereby providing a level of cardiac output sufficient to maintain life in spite of the arrhythmia without necessarily defibrillating the patient.

add B' add CB